

## Effect of orlistat and aquatic extract of *Rosmarinus officinalis* leaves in histopathological changes in kidney of albino rat

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### Abstract

This study investigated the effects of orlistat and rosemary extract on kidney tissue when combined with a high-fat diet, as well as the association between these treatments and body weight, blood lipid profile, and oxidative stress status in male rats. 42 rats weighing 170-200 grams were divided into seven groups, each consisting of six rats. The experiment lasted 20 weeks and was divided into two phases: a stage of induced obesity using high-fat food (fattened), which lasted from week 0 to week 12, except for the control group, which was fed a normal diet. The treatment period lasted from week 12 to week 20, with daily dosing. When compared to the high-fat diet and the rest of the groups, the weights of the animals increased significantly, as did the lipid profile like TC and LDL, TG, and VLDL in the blood, which were accompanied by decrease in the levels of glutathione and increase malondialdehyde. When given a high-fat diet and orlistat, histopathological examination of the kidneys revealed changes in the renal tissue, including glomerular atrophy, necrosis and cloudy swelling of epithelial cells lining renal tubules, whereas when given the extract with orlistat, these effects were reduced. We conclude that rosemary aqueous extract has preventive and therapeutic antioxidant properties, as evidenced by its improved effect on the histopathological changes induced by orlistat drug in kidney tissue, as well as its improving effect on the state of oxidative stress in the kidney tissue and the level of lipids profile in the blood, and its weight-loss efficacy.

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### Introduction

For the past 40 years, obesity has been a major public health concern in industrialized societies, as obesity increases the risk of end-stage kidney disease (ESRD), and excess weight plays an important role in the development of proteinuria and kidney damage in patients with severely reduced renal mass (1). Lipase is an enzyme produced by the pancreas that induces lipolysis and combines with food in the duodenum. It is involved in the digestion, transportation, and processing of dietary fats (such as triglycerides, fats, and oils) in most organisms (2). Orlistat was released in the United Kingdom by Roche

Pharmaceuticals, and the medicine has attracted a lot of media attention. It's the first member of a new medication class that alters dietary fat absorption. Life and the scarcity of food orlistat, a semi-synthetic hydrogenated derivative of *Streptomyces oxytricini*'s natural lipase inhibitor, is thought to have few negative effects. Fat absorption is reduced by more than 30% as a result of this restriction (3). Orlistat's mechanism of action and metabolism is that it binds covalently to the active site of pancreatic lipase and creates a stable complex, Fats are broken down into fatty acids and monoglycerides, which are expelled in the feces, by inactive lipase. Orlistat use has been linked to several mild to moderate gastrointestinal side effects, as well as

nephrotoxicity and hepatotoxicity (4). Natural antioxidants, rosemary extracts (*Rosmarinus officinalis* L.), are utilized in food, nutritional supplements, and cosmetics (5). It has anti-inflammatory and anti-hyperglycemic properties, as well as aiding weight reduction because of its ability to decrease lipid absorption, which can be used to develop new preventive measures for metabolic disorders, as fat excretion from the feces increases while food intake does not. Fasting blood sugar and plasma cholesterol levels are also reduced by the extract (6).

We decided to conduct this study to verify the side effects associated with the use of orlistat in two different doses alone and when given with aqueous extract of rosemary at the level of renal tissue changes and their relationship to the level of blood lipids and the state of oxidative stress in the kidney as measured by the levels of malondialdehyde and glutathione in the renal tissue.

## **Materials and methods**

### **Animals and breeding**

Adult male rats weighing between 170-200 g were employed in this experiment, with 42 animals total. The animals were placed into seven groups at random, each with six animals. The animals were grown in the College of Veterinary Medicine / University of Mosul's animal home in plastic cages. The standard breeding conditions were 12 hours of light and 12 hours of darkness, with a laboratory temperature of  $24 \pm 2^\circ\text{C}$ . In addition to supplying the animals with adequate water and food during the duration of the experiment. Before beginning the experiment, the animals were left for a week to allow adaption.

### **Chemicals and medicines**

Orlistat was used in this experiment in the form of a capsule from a Hikma pharmaceutical company, Jordan. that was dissolved in distilled water and administered to each animal in an oral dosage syringe according to its weight. The rosemary extract was made by harvesting ripe rosemary leaves and drying them in the shade at room temperature for 15 days. The rosemary leaves were thoroughly rinsed in distilled water, air dried, and ground into a coarse powder. Two minutes were spent boiling 8 grams (g) of powder dissolved in 100 mL of distilled water. A clear solution approximately 60 ml was obtained after cooling (approximately 1 hour) and filtering through filter paper. The extract was given to the rats via a stomach tube within 24 hours of preparation 10 ml/kg/day (7). An apparatus was used to estimate the concentration of lipid profile in the blood is Cobas C311, Hitachi, Japan.

### **Therapies and preparations**

The experiment lasted 20 weeks and was divided into two phases: induced obesity using a high-fat diet contain 30% beef fat and 5% sunflower oil (8). The rats were fed this diet from week 0 to week 12, except the control group,

which was fed a normal diet throughout the experiment. The treatment period lasted from week 12 to week 20 daily oral dosing, with the following groups; the first group received distilled water as a daily dose as control group. The second group received only a high-fat diet. The third group received a high-fat diet plus a rosemary aqueous extract 10 ml/kg. The fourth group, in which the rats were administered a high-fat diet along with 100 mg/kg of orlistat. The fifth group, in which rats were administered a high-fat diet along with 200 mg/kg of orlistat. The sixth group, in which the rats were fed a high-fat diet with orlistat drug at a dose of 100 mg/kg, as well as watery rosemary extract at a dose of 10 ml/kg. The seventh group, in which the rats were fed a high-fat diet with orlistat drug at a dose of 200 mg/kg, as well as watery rosemary extract at a dose of 10 ml/kg after 4 weeks and 8 weeks of therapy, the animals' weights were recorded, and they were then starved for 12 hours yet only given water. The animals were then anesthetized with ether and capillary tubes were used to take blood from the eye socket. Blood samples were left to be separated after they were obtained. The serum and its preparation for biochemical measurements of the blood lipid profile.

### **Tissue preparation**

After the animals were sacrificed, the kidneys were removed and thoroughly cleaned with tap water, before being placed on blotting paper and a fraction of each sample obtained. It was centrifuged, and the filtrate was removed and stored at  $-20^\circ\text{C}$  until malondialdehyde (9) and glutathione were examined according to Moron's technique (10).

Parts of each kidney sample were collected, cleaned carefully, and fixed in a 10% formalin solution for 48 hours before tissue sections were produced and embedded in paraffin wax. Tissue sections were cut to a thickness of around 5 microns, then stained with hematoxylin-eosin dye to evaluate histopathological changes under light microscopy.

### **Statistical analysis**

The data were represented as an arithmetic average and standard error, the SPSS program was used to do statistical analysis using one or two-way analysis of variance, depending on the experiment. The results were then put through the LSD test, with a probability level of  $P < 0.05$ .

## **Results**

Table 1 reveals that all groups differ significantly from the control group, as well as a substantial rise in animal weights when compared to the second fattened group and the rest of the groups. Except for the seventh group, which showed a significant difference compared to all other groups, the sixth group exhibited a significant difference compared to all other groups.

Table 2 shows a significant difference in the lipid profile, with significantly higher levels of total cholesterol, triglycerides, LDL-C, and VLDL-C in all groups when compared to the control group, and a significant increase in their levels when compared to the second group high-fat diet and the other groups. Except for the seventh group, which showed a significant decrease compared to all other groups, the sixth group exhibited a significant difference compared to all other groups. When comparing the control group and the third group alone, the levels of high-density lipoprotein HDL-C were found to be significantly lower in the groups treated with orlistat alone and the fatty group. The two groups sixth and seventh showed improvement

when compared to the groups treated with the third, fourth, and fifth groups.

When compared to the control group and the rest of the groups, the results of oxidative stress revealed a significant decrease in glutathione accompanied by an increase in malondialdehyde in both the second group and the fifth group. In comparison to the control group and the other groups, the third group demonstrated a significant increase in glutathione levels and a decrease in malondialdehyde levels. Glutathione and malondialdehyde levels were improved in the sixth and seventh groups, where glutathione levels increased much more than in the control group, second, and fourth and fifth groups (Table 3).

Table1: A table showing the weights of the animals after 4 and 8 weeks of treatment

Groups and Transactions	Gram/ Body weight after 4 weeks	Gram/ Body weight after 8 weeks
First group (control)	296.75 $\pm$ 4.09	282.25 $\pm$ 2.49
Second group	369.50 $\pm$ 2.32*	385.50 $\pm$ 1.32*
Third group	347.75 $\pm$ 1.19*	333.75 $\pm$ 3.19*a A
Fourth group	338 $\pm$ 2.54*	322 $\pm$ 2.64*a A
Fifth group	332 $\pm$ 2.54*	320 $\pm$ 3.54*a A
Sixth group	323.5 $\pm$ 2.59*	307.0 $\pm$ 5.59* abc,A
Seventh group	323.0 $\pm$ 1.70*	302.0 $\pm$ 3.34*abcd, A

P<0.05. \* This means significantly different from the control group. A- mean significant difference from weight after 4 weeks. a- mean significant difference from fattened group. b- mean significant difference from Rosemary Extract 10 ml/kg. c- mean significant difference from orlistat 100mg/kg. d- means significant difference from orlistat 200 mg/kg.

Table 2: showing the lipid profile in the blood of rat after 8 weeks of treatment

Groups	TC mg/dl	TG mg/dl	HDL-C mg/dl	LDL-C mg/dl	VLDL-C mg/dl
First group (control)	63.4 $\pm$ 2.38	72 $\pm$ 3.46	44.1 $\pm$ 4.519	22.4 $\pm$ 1.28*	14.4 $\pm$ 0.40*
Second group	138.4 $\pm$ 3.50*	144.4 $\pm$ 5.24*	23.2 $\pm$ 1.68*	63.8 $\pm$ 1.15*	28.78 $\pm$ 0.283*
Third group	121.8 $\pm$ 5.38*a	121.8 $\pm$ 5.38*a	39.8 $\pm$ 1.588*a	46 $\pm$ 2.09*a	24 $\pm$ 1.433*a
Fourth group	93.8 $\pm$ 5.31*ab	106.8 $\pm$ 2.78*ab	36.4 $\pm$ 4.40*ab	37.8 $\pm$ 1.95*ab	21.21 $\pm$ 0.47*ab
Fifth group	84.4 $\pm$ 2.54*ab	95 $\pm$ 2.4 * ab	31.0 $\pm$ 2.44* ab	40.2 $\pm$ 2.22*ab	19.02 $\pm$ 0.3*ab
Sixth group	81.36 $\pm$ 3.33*abc	83.34 $\pm$ 2.74*abc	42.0 $\pm$ 2.28*abc	42.6 $\pm$ 1.503*abc	16.7 $\pm$ 0.17*abc
Seventh group	69.60 $\pm$ 2.27*abcd	73.9 $\pm$ 1.81*abcd	35.8 $\pm$ 5.063*abcd	29 $\pm$ 1.503*abcd	18.8 $\pm$ 0.3*abcd

P<0.05. \* means significantly different from the control group. a- mean significant difference from fattened group. b- mean significant difference from Rosemary Extract 10 ml/kg. c- mean significant difference from orlistat 100mg/kg group. d- means significant difference from orlistat 200 mg/kg group.

Table3: showing the level of GSH, MDA in tissue extract of kidney of rat after 8 weeks of treatment

Groups and Transactions	GSH Micromol/Gr	MDA Nanomol/Gr
First group (control)	2.27 $\pm$ 0.04	148.0 $\pm$ 0.753
Second group	1.09 $\pm$ 0.039*	364.33 $\pm$ 1.92*
Third group	3.85 $\pm$ 0.093 *a	117.31 $\pm$ 0.954*a
Fourth group	2.01 $\pm$ 0.08 ab	205.4 $\pm$ 0.55* ab
Fifth group	1.608 $\pm$ 0.48*abcd	221.81 $\pm$ 0.837* abcd
Sixth group	2.11 $\pm$ 0.075 abcd	139.0 $\pm$ 0.850* abcd
Seventh group	2.211 $\pm$ 0.036 abd	142.0 $\pm$ 0.868* abcd

P<0.05. \* means significantly different from the control group. a- mean significant difference from fattened group. b- mean significant difference from Rosemary Extract 10 ml/kg. c- mean significant difference from orlistat 100mg/kg group. d- means significant difference from orlistat 200 mg/kg group.

The histopathology of rat kidney of control group shows normal architecture of renal tissue characterized by glomeruli, surrounding by well-arranged proximal renal tubules and distal renal tubules (Figures 1 and 2).

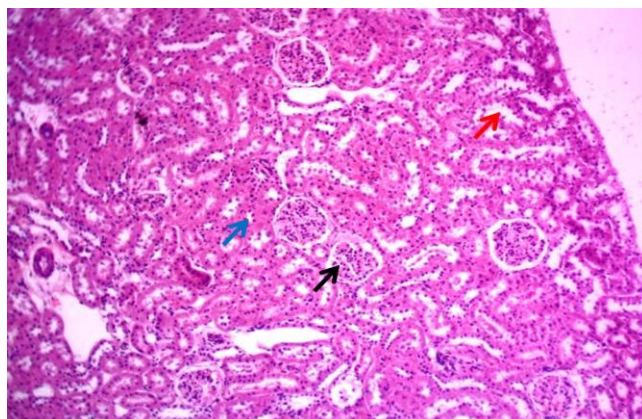


Figure 1: rat kidney of first group (control) shows normal architecture of renal tissue characterized by glomeruli (→), surrounding by arranged proximal renal tubules (→) and distal renal tubules (→). H&E stain, 100X.

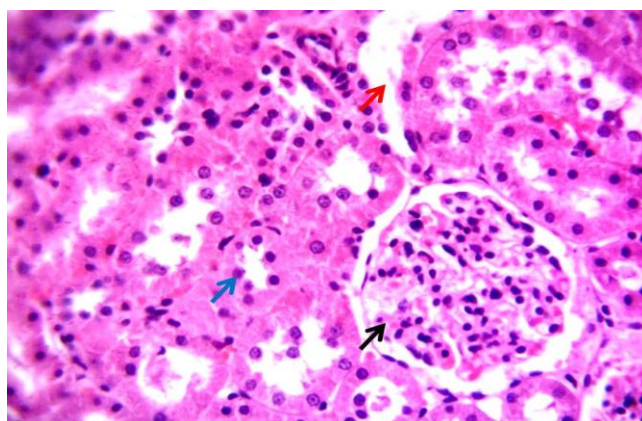


Figure 2: rat kidney of first group (control) shows normal architecture of renal tissue characterized by glomeruli (→), surrounding by arranged proximal renal tubules (→) and distal renal tubules (→). H&E stain, 400X.

In fattened treated rat kidney showed destruction of renal glomeruli and tubules as evidenced by fatty change, glomerulosclerosis, inflammatory cell infiltration, blood vessel congestion, glomerulus atrophy and necrosis, and vacuolar degeneration of epithelial cells lining renal tubules, as well as hemorrhage (Figures 3-6). The third group revealed normal architecture of renal tissue characterized by glomeruli, surrounding by arranged proximal renal tubules and distal renal tubules with mild dilation of few renal tubules (Figures 7 and 8), while the fourth group showed destruction of some renal glomeruli and tubules represented by dilation of Bowman's space,

glomerulus atrophy, cloudy swelling of epithelial cells lining renal tubules and congestion (Figures 9 and 10), whereas the kidney of the fifth group showed destruction of renal glomeruli and tubules representing by dilation of Bowman's space, glomerular atrophy, necrosis and cloudy swelling of epithelial cells lining renal tubules, and inflammatory cells infiltration (Figure 11). The sixth group revealed normal architecture of renal tissue characterized by glomeruli surrounding by normal proximal renal tubules with mild dilation of Bowman's space, mild atrophy of few glomeruli and hemorrhage (Figure 12), finally the seventh group revealed mild dilation of Bowman's space, mild atrophy of few glomeruli, normal proximal and distal renal tubules and hemorrhage (Figures 13 and 14).

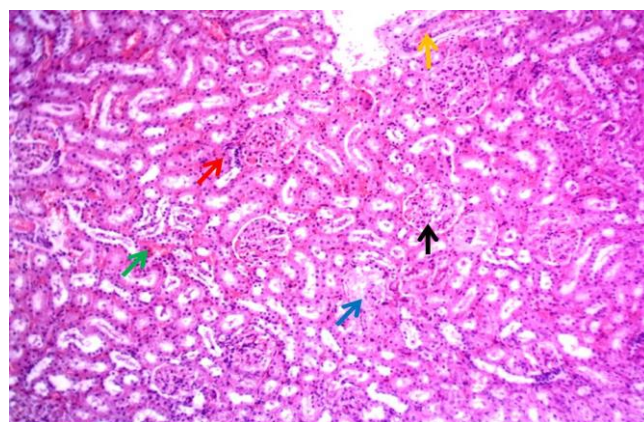


Figure 3: rat kidney of second group shows destruction of renal glomeruli and tubules representing by fatty change (→), glomerulosclerosis (→) inflammatory cells infiltration (→), congestion of blood vessels (→) and hemorrhage (→). H&E stain, 100X.

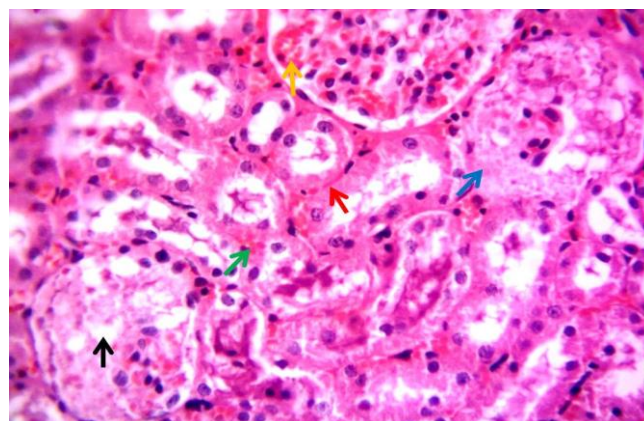


Figure 4: rat kidney of second group shows destruction of renal glomeruli and tubules representing by glomerulosclerosis (→), necrosis of epithelial cells lining renal tubules (→), congestion of blood vessels (→) and hemorrhage (→). H&E stain, 400X.



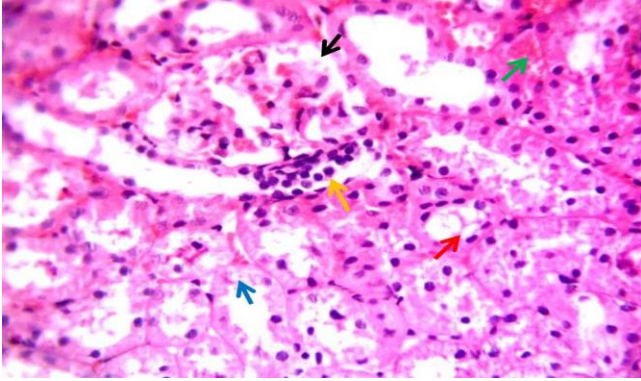


Figure 5: rat kidney of second group shows destruction of renal glomeruli and tubules representing by dilation of Bowman's space (→), necrosis (→) and vacuolar degeneration (→) of epithelial cells lining renal tubules, inflammatory cells infiltration (→) and hemorrhage (→). H&E stain, 400X.

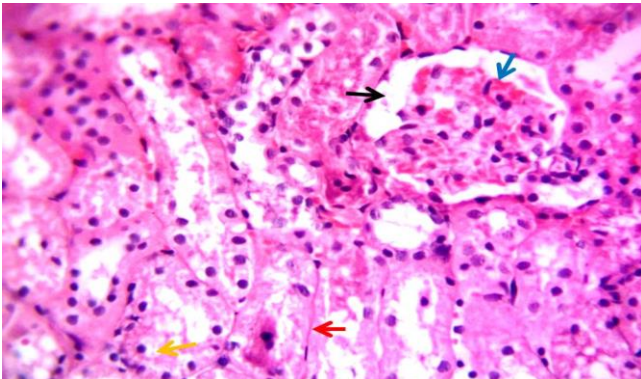


Figure 6: rat kidney of second group shows destruction of renal glomeruli and tubules representing by dilation of Bowman's space (→), glomerulus atrophy (→) and necrosis (→) and vacuolar degeneration (→) of epithelial cells lining renal tubules. H&E stain, 400X.

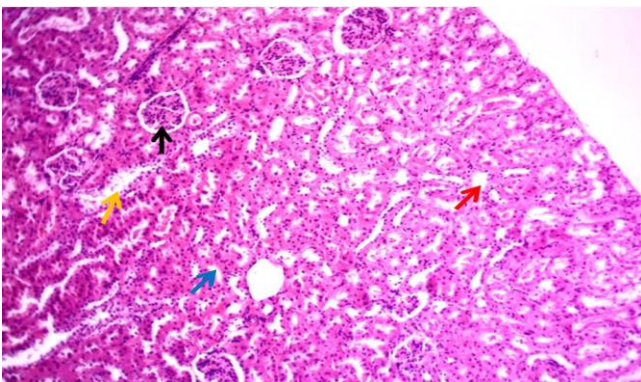


Figure 7: rat kidney of third group shows normal of renal glomeruli (→), proximal (→) and distal renal tubules (→) mild dilation of few renal tubules (→). H&E stain, 100X.

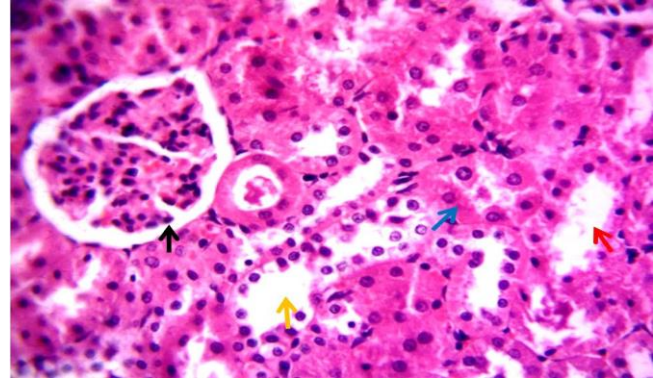


Figure 8: rat kidney of third group shows normal architecture of renal tissue characterized by glomeruli (→), surrounding by well-arranged proximal renal tubules (→) and distal renal tubules (→) with mild dilation of few renal tubules (→). H&E stain, 400X.

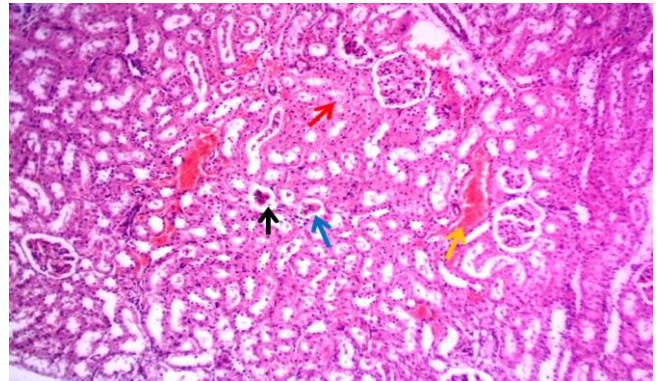


Figure 9: rat kidney of fourth group shows destruction of some renal glomeruli and tubules representing by dilation of Bowman's space (→), glomerulus atrophy (→), cloudy swelling (→) of epithelial cells lining renal tubules and congestion (→). H&E stain, 100X.

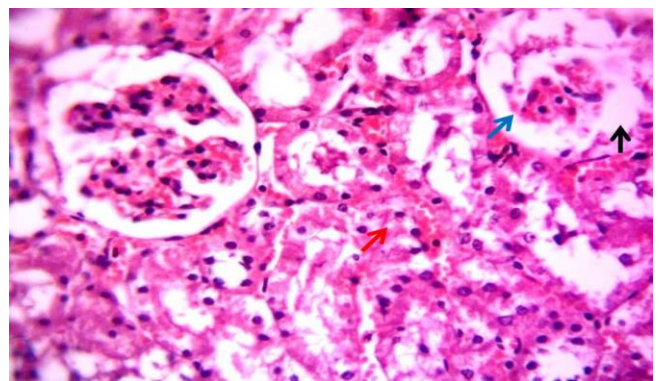


Figure 10: rat kidney of fourth group shows dilation of Bowman's space (→), glomerulus atrophy (→) and cloudy swelling (→) of epithelial cells lining renal tubules. H&E stain, 400X.



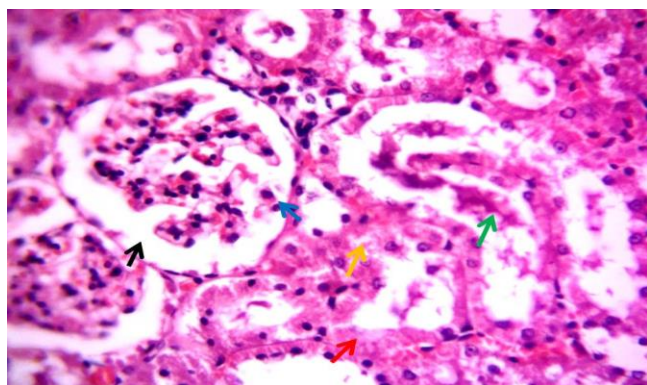


Figure 11: rat kidney of fifth group shows dilation of Bowman's space (→), glomerulus atrophy (→), necrosis (→) and cloudy swelling (→) of epithelial cells lining renal tubules, desquamation of few renal tubules (→). H&E stain, 400X.

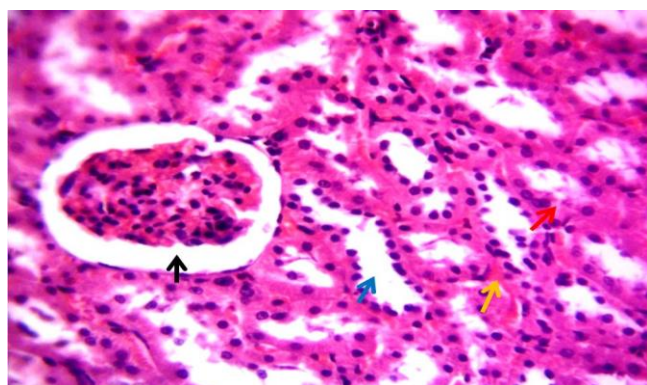


Figure 12: rat kidney of sixth group shows normal architecture of renal tissue characterized by glomeruli with mild dilation of Bowman's space (→) surrounding by normal proximal (→) and distal (→) renal tubules and hemorrhage (→). H&E stain, 100X.

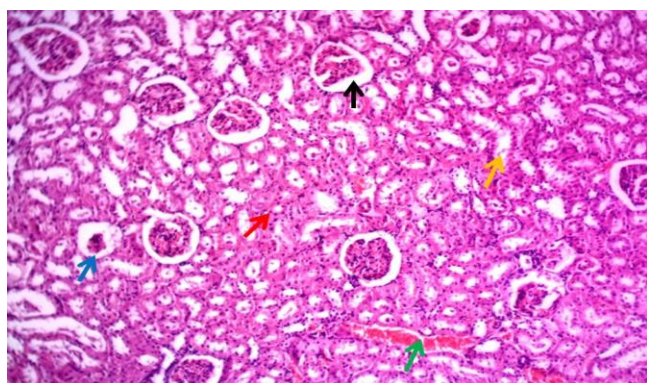


Figure 13: rat kidney of seventh treated group shows mild dilation of Bowman's space (→), mild atrophy of few glomeruli (→), normal proximal (→) and distal (→) renal tubules and congested blood vessel (→). H&E stain, 100X.

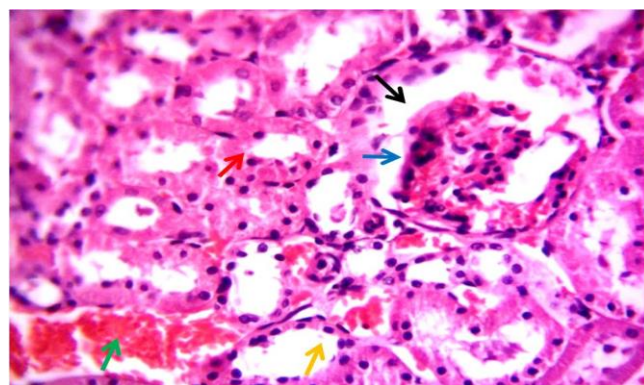


Figure 14: rat kidney of seventh group shows mild dilation of Bowman's space (→), mild atrophy of few glomeruli (→), normal proximal (→) and distal (→) renal tubules and congested blood vessel (→). H&E stain, 400X.

## Discussion

Orlistat is known to help people lose weight by improving metabolism and, as a result, improving kidney and liver function (4). Our recent research found that feeding rats a high-fat diet resulted in an increase in body weight as well as a rise in blood fat levels. The administration of orlistat at doses of 100 and 200 mg/kg resulted in a considerable reduction in the weight of the animals after 8 weeks of treatment, with the animals weighing less When compared to a control group and a group given a high-fat diet. This result corresponds with several studies that showed orlistat has a weight-loss effect by improving metabolism through its influence on fat absorption, where orlistat is covalently bonded to the active site in Pancreatic lipase and forms a stable complex This combination causes the enzyme to alter conformation, resulting in a cap-like structure on the lipase (11,12). The active site of the enzyme is altered, rendering it inactive. Inactive lipase is incapable of converting fats into fatty acids and monoglycerides, then fat is eliminated in the feces (13). These findings matched the lipid profile in the blood, which showed considerable reductions in total cholesterol, triglyceride, and low-density lipoprotein. While the levels of high-density lipoprotein increased in the groups given orlistat in its two doses, when administered alone or with rosemary extract, indicating that orlistat limits fat absorption in the intestine and causes fat feces excretion (14). Orlistat has been shown to reduce dietary cholesterol by blocking cholesterol transport The cholesterol that is absorbed by the small intestine and transported to the circulatory system, adipose tissue, and endothelium muscles are broken down into triglycerides by lipoprotein lipase, leaving cholesterol residues that are high in cholesterol behind (15). Thus, orlistat inhibits cholesterol absorption and contributes to lowering cholesterol concentrations; it also aids in the reduction of total cholesterol, triglycerides, LDL-C, and very-low-density

lipoprotein VLDL-C particles, which is reflected in a reduction in body weights in animals (16).

Additionally, rosemary extract is known for its potential to help people lose weight and works in our study in conjunction with orlistat. The levels of glutathione in the groups treated with rosemary extract were significantly higher, while malondialdehyde was lower in these groups, according to our findings. This is because rosemary extract contains the antioxidant compounds L-carnosic acid and carnosol, which have been classified as additive E by the European Food Safety Authority, confirming its value as a natural preservative in foods and beverages (17,18). In vitro antioxidant activity of rosemary extract rich in carnosic acid has been observed in studies due to its ability to absorb oxygen radicals and reduce ferric acid, which prevents LDL-C oxidation (19).

In comparison to control rats and group rats treated with an aqueous extract of rosemary, the HFD diet resulted in a substantial drop in GSH and a substantial increase in MDA in the kidneys in our current investigation. The orlistat-treated groups had similar outcomes. The effect of orlistat on oxidative stress was directly related to the dose, with the 200 mg/kg dose having the greatest effect. This is related to oxidative stress caused by an imbalance between increased ROS generation and reduced antioxidant activity, which causes oxidative damage to lipids, proteins, and DNA in cells and organs (20). The status of oxidative stress improved in the groups treated with both the drug and the extract. According to what was reported in many sources, rosemary extract helped the pathological condition because it is regarded as a strong natural antioxidant (21). Although weight loss is linked to lower blood lipid levels, our histopathological examination of kidney tissue revealed that orlistat harms the organ, as it caused a breakdown in some kidney tubules with glomerular atrophy and an expansion of Bowman's capsule with congestion and bleeding. The cause of these orlistat-related pathological renal consequences is thought to be hyperoxaluria. Failure to absorb fats in the small intestine results in the production of a soapy material, which when combined with calcium creates oxalate, which then enters the bloodstream and deposits in the kidneys, causing health problems (22,23).

Another study that looked at the effects of orlistat on kidney function found that it could contribute to the development of oxidative nephropathy, kidney stone disease, and an increased risk of acute renal injury. In one investigation, similar outcomes were found, orlistat caused the emergence of a focal necrotic area with infiltration of inflammatory cells, the appearance of blood vessels, and congestion of some renal tubules with degeneration due to nephritis, which leads to chronic tubular interstitial nephropathy and acute tubular necrosis with increased uric acid in the blood and the formation of renal urate crystals, which leads to chronic tubular interstitial nephropathy and acute tubular necrosis (24).

Such changes were not observed in the kidneys of animals treated with rosemary extract in our current study, where rosemary was successful in alleviating the harmful effects of orlistat on the kidneys, as the combination of orlistat drug with rosemary did not show similar histopathological symptoms, and it appears from the results of our current study that Rosemary can have a preventive effect on the kidneys. Obesity has been linked to an increase in oxidative stress, which has been linked to the development of obesity-related kidney disease in studies (23). The formation of free radicals may be the mechanism behind the onset or progression of kidney damage in obese people. ROS are extremely reactive chemicals that oxidize lipids and proteins, cause cell damage, and increase glomerular tubule and kidney injury, as well as proteinuria (20). Increased oxidative stress in renal tissue is related to histological damage to the kidneys, which is defined by a decrease in the activities of antioxidant enzymes and glutathione levels, which correlates with an increase in MDA and carbonyl protein levels in most tissues (25).

## Conclusion

We conclude from this research that rosemary aqueous extract has preventive and therapeutic antioxidant properties, as evidenced by its improved effect on the pathological changes induced by the drug orlistat in kidney tissue, as well as improvements in the state of oxidative stress in the kidney tissue, the level of fat in the blood, and weight loss.

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## Conflict of interest

There is no conflict of interest.

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## تأثير اورليستات والمستخلص المائي لأوراق إكليل الجبل في التغييرات النسجية المرضية في كلية الجرذان البيضاء

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### الخلاصة

بحثت هذه الدراسة تأثيرات الأورليستات ومستخلص إكليل الجبل على أنسجة الكلى عند دمجه مع نظام غذائي عالي الدهون، بالإضافة إلى الارتباط بين هذه المعالجات ووزن الجسم ونسبة الدهون في الدم وحالة الإجهاد التأكسدي في ذكور الجرذان. تم تقسيم ٤٢ جرذاً وزن ١٧٠-٢٠٠ غرام إلى سبع مجاميع، كل منها تتكون من ستة جرذان. استغرقت التجربة ٢٠ أسبوعاً وتم تقسيمها إلى مرحلتين: مرحلة السمّة التحريضية باستخدام الغذاء العالي بالدهون (المسمّن)، والتي استمرت من الأسبوع ٠ إلى الأسبوع ١٢، باستثناء مجموعة السيطرة التي تم تغذيتها بنظام غذائي عادي طوال فترة التجربة. استمرت فترة العلاج من الأسبوع ١٢ إلى الأسبوع ٢٠ مع التجريب اليومي. عند المقارنة بين المجموعة المسمّنة (الغذاء العالي بالدهون) وباقي المجموع، ازدادت أوزان الحيوانات بشكل ملحوظ كما زادت نسبة الدهون في الدم والتي صاحبها انخفاض في مستويات الكلوتاثيون وارتفاع المألوندايديهايد. أظهر الفحص النسيجي للكلى في المجموع بالنظام الغذائي بالدهون مع الأورليستات تغييرات مرضية نسيجية في الكلى شملت تحطم الكبيبات والنبيبات الكلوية المتمثل بضمور الكبيبات والنخر والتورم الغيمي للخلايا الظهارية المبطنّة للنبيبات الكلوية وقلت هذه التغييرات عند إعطاء المستخلص مع أورليستات. نستنتج أن المستخلص المائي لإكليل الجبل له خصائص مضادة للأكسدة وقائية وعلاجية، كما يتضح من تأثيره المحسن على التغييرات النسيجية التي يسببها عقار أورليستات في أنسجة الكلى، وكذلك تأثيره المحسن على حالة الإجهاد التأكسدي في أنسجة الكلى ونسبة الدهون في الدم فضلاً عن فعاليته في إنقاص الوزن.